F·A·A·M facility for airborne atmospheric measurements

# FLIGHT FOLDER


| | |
|---|---|
| Flight No.: | B098 |
| Date: | 26 May 2005 |
| Take Off | 09:44:18 |
| Landing: | 13:29:58 |
| Flight Time | 3h 45m 40 |

**Campaign:** CWVS / CIRRUS
**Trials Instructions:**
**Operating Area:** Chilbolton

| POB | Position | Name | Institute |
|---|---|---|---|
| 1 | Captain | Alan Roberts | Directflight |
| 2 | Co-pilot | Charlie Whitaker | BAES |
| 3 | CCM | Sue Angold | Directflight |
| 4 | Mission Scientist | Richard Cotton | Met Office |
| 5 | Flight Manager | Jim Crawford | FAAM |
| 6 | CCN/CVI | Paul James | FAAM |
| 7 | Core Chemistry | Alan Woolley | FAAM |
| 8 | Cloud Physics | Jamie Trembath | FAAM |
| 9 | CPI | Keith Bower | Manchester |
| 10 | AMS | Jonny Crosier | Manchester |
| 11 | Observer | Steve Ball | FAAM |
| 12 | | | |
| 13 | | | |
| 14 | | | |
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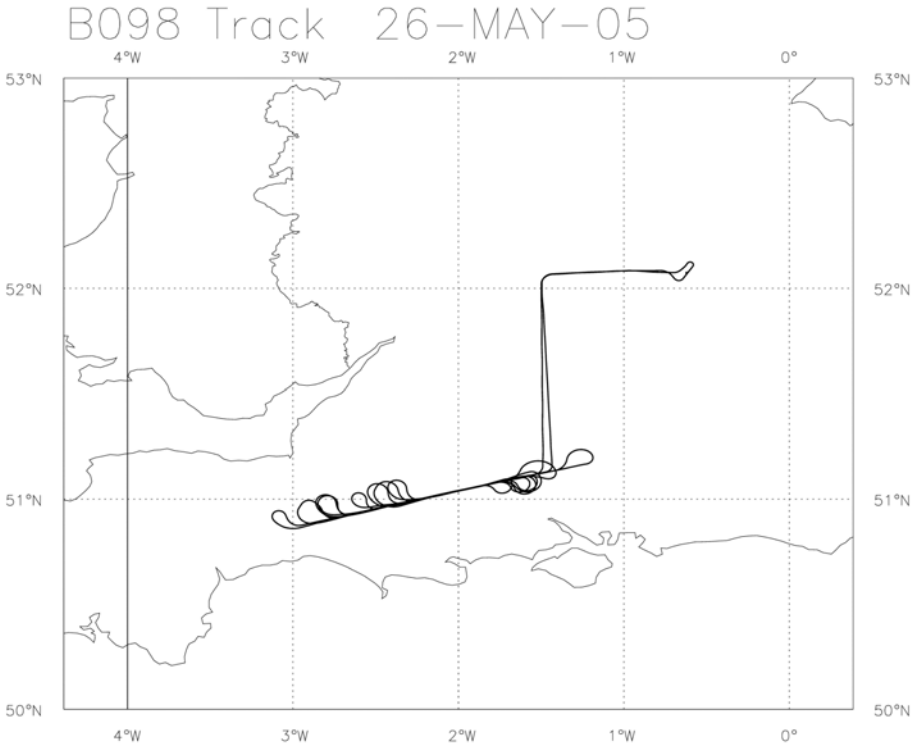
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |

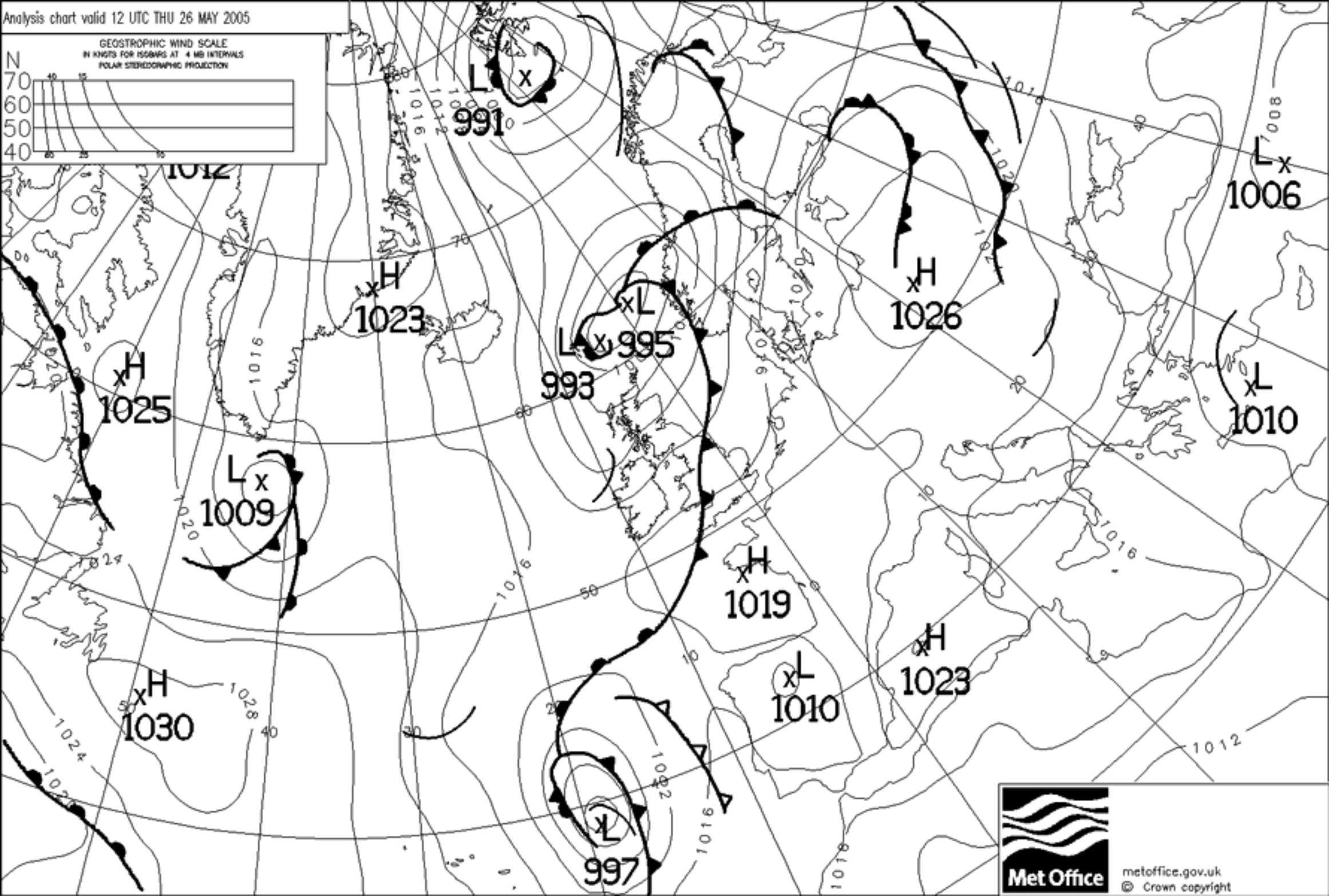
**Flight Track:**



FLIGHT SUMMARY

Flight No B098
Date: 26 May 2005
Project: CWVS / Cirrus
Location: Chilbolton

| Start Time | End Time | Event | Height (s) | Hdg | Comments |
|---|---|---|---|---|---|
| 092851 | | INU to NAV Cranfield | 0.30 kft | 125 | 52 04.36N 000 37.48W |
| 094418 | | T/O Cranfield | 2.4 kft | 316 | 09:44:18 |
| 094932 | | ASPs open | 5.0 kft | 263 | |
| 095328 | | video tapes | 5.0 kft | 225 | FFC & DFC to record |
| 100759 | 102232 | Profile 1 | 3.6 - 18.0 kft | 256 | 3500' to fl240 interrupted at fl180 |
| 102721 | 103514 | Profile 1.2 | 18.0 - 25.0 kft | 083 | recommenced interrupted at fl250 |
| 104107 | 104538 | Profile 1.3 | 25.0 - 28.0 kft | 250 | recommenced to fl280 |
| 105255 | 105943 | Run 1 | 22.1 - 22.0 kft | 086 | fl220 |
| 110237 | 110832 | Run 2 | 21.0 - 21.1 kft | 251 | fl210 |
| 111258 | 111853 | Run 2.2 | 21.0 kft | 087 | towards Chilbolton overhead |
| 112620 | 113258 | Run 3 | 23.0 kft | 252 | fl230 |
| 113650 | 114055 | Run 4 | 25.0 kft | 079 | fl250 |
| 114355 | 114906 | Run 4.2 | 25.1 - 25.0 kft | 255 | fl 250 outbound |
| 114921 | | Nev cals | 25.0 kft | 258 | |
| 115345 | 115717 | Run 5 | 27.0 kft | 071 | fl270 |
| 120028 | 121207 | Run 5.2 | 27.1 - 27.0 kft | 255 | |
| 121529 | 122232 | Profile 2 | 27.1 - 32.0 kft | 075 | |
| 122626 | 122908 | Profile 2.2 | 32.1 - 33.1 kft | 245 | |
| 123909 | 124520 | Run 6 | 20.1 - 20.0 kft | 088 | fl200 |
| 125034 | 125607 | Run 7 | 16.1 kft | 250 | fl160 |
| 130001 | 130406 | Run 7.2 | 16.1 kft | 080 | |
| 130450 | | end of science | 15.0 kft | 076 | |
| 130754 | | asp closed | 7.0 kft | 357 | |
| 132958 | | land Cranfield | 0.28 kft | 355 | 13:29:58 |
| 133448 | | Cranfield apron2 | 0.28 kft | 307 | 52 04.36N 000 37.48W |


Analysis chart valid 12 UTC THU 26 MAY 2005
GEOSTROPHIC WIND SCALE
IN KNOTS FOR ISOBARS AT 4 MB INTERVALS
POLAR STEREOGRAPHIC PROJECTION
N
70
60
50
40
40
15
60
25
10
L 991
H 1023
L 995
993
H 1026
L 1006
H 1025
L 1009
L 1010
H 1019
H 1030
L 1010
H 1023
L 997
1012
1016
1020
1024
1028
1032
1008
Met Office
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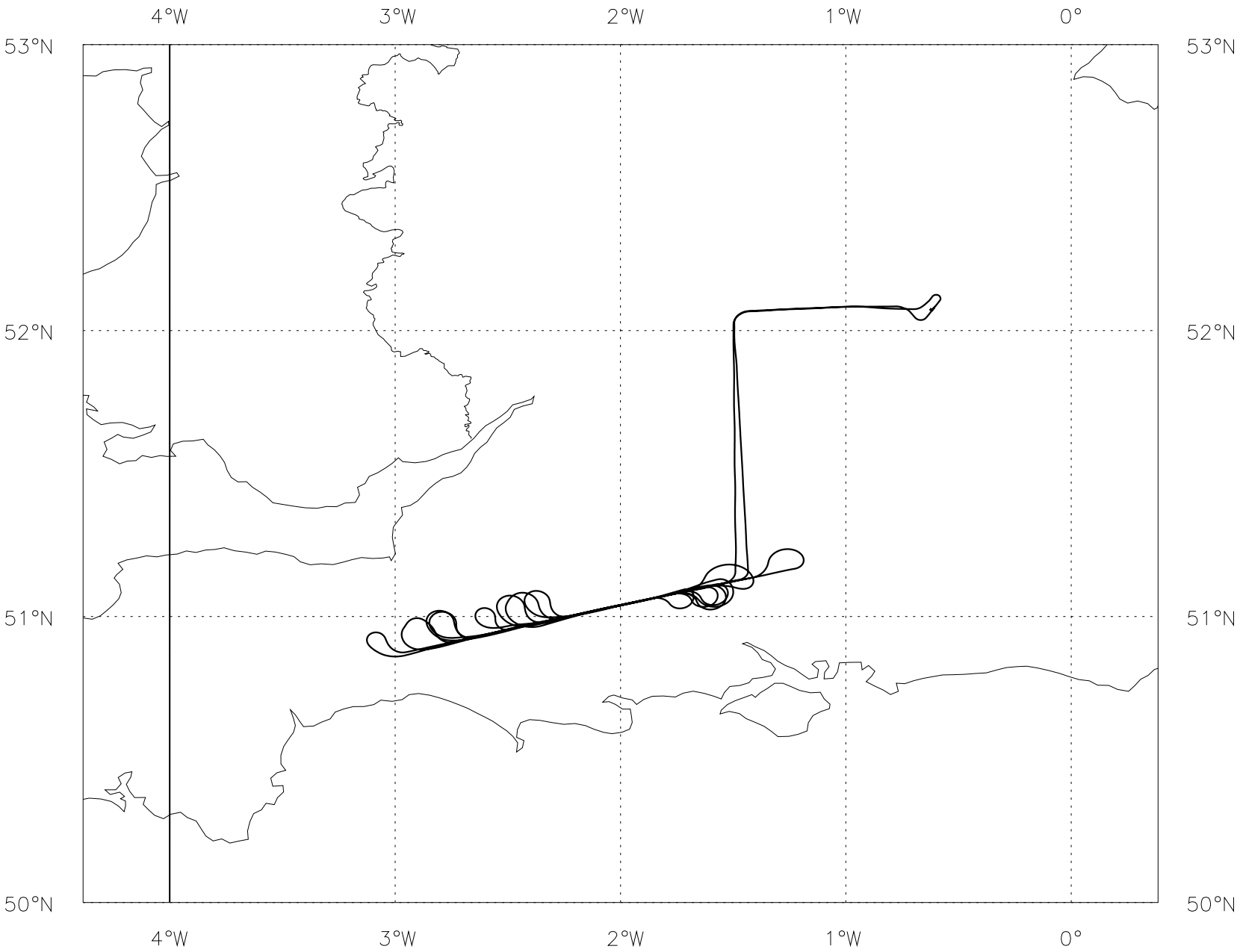
# B098 Track 26-MAY-05



Top 10.5
SLW 4 → 5 (-10 to -16°C) 253 mb.
FL 0C 3.0

**Sortie Brief: CWVC – mixed-phase cloud studies**
**Flight Number: B098** **Date: 26 May 2005**

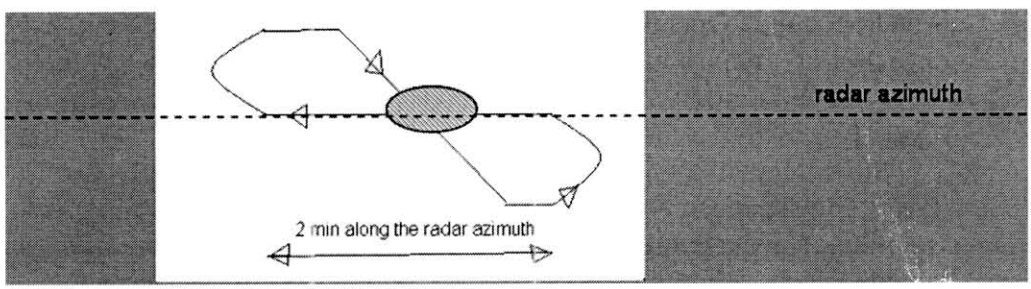
**Sortie Aims:** To measure ice and liquid-phase microphysical processes and cloud dynamics in stratiform cloud systems in association with Chilbolton radar.

**Sortie Location:** Within a stratiform cloud system over or to the west of Chilbolton radar facility.

**Sortie Summary:** Perform a series of runs along the azimuth that is being scanned by the radar. Information on the run orientation and altitude to be flown will be provided by scientists at Chilbolton using VHF radio (127.050 MHz, call-sign "Radsearch"). Where the radar identifies a small-scale feature of interest, the aircraft may abort a long leg in order to turn to re-penetrate it. In this case, the aircraft may fly a small butterfly pattern in which only one of the legs is parallel to the wind direction or radar azimuth. Where either the aircraft or radar identifies a particular horizontal layer of interest, the aircraft may fly a sawtooth pattern so as to provide a sequence of profiles. On occasion, the aircraft flight legs may start/finish in the Chilbolton overhead. This benefits the validation of vertically-pointing radar/lidar retrievals of supercooled cloud layers. This requires turns to be done within controlled airspace.

**Sortie Detail:**

a) T+0 Take off and climb to FL060 for transit to the operating area west of Chilbolton. 3500m.
b) T+40 When in a suitable location, perform a profile descent at 1000ft/min from FL200 to 1000ft agl or 1000 ft below the freezing level, whichever is the lower (20 min) PROFILE ASCENT OBS UP TO TOPS.
c) T+60 Establish start/end points of 40-80km flight leg along the azimuth which is being scanned by the radar. Fly this leg at altitudes defined by the radar. Duration of each leg ~ 5-10 minutes. Some legs may be extended into the overhead position of Chilbolton when requested from the ground.
d) Where the radar identifies a feature of interest that is penetrated by the aircraft along any leg, the leg may be interrupted to fly one or more butterfly patterns. Each butterfly consists of a minimum of two minutes straight/level that includes penetration of the feature followed by turns that allow re-penetration of the feature during the reciprocal part of the pattern (see diagram)




e) Where a defined layer of interest (such as a shallow layer of supercooled liquid water) is identified by the aircraft or radar, the long leg may be flown as a sawtooth leg with ascents/descents at 1000ft/min, extending 1000ft above and below the layer level ~~and with level segments of 1 minute.~~
f) Items c) to e) may be repeated as long as flight endurance or cloud conditions permit.

11.15.

**PROJECT BRIEF: CWVC – mixed-phase cloud studies**

**Scientific Aims:** The purpose of this project is to obtain detailed microphysical measurements in stratiform cloud systems that lie within the temperature regime in which mixed-phase clouds are possible (typically 0 to -30C). In particular, we wish to examine the competing roles of

- primary ice nucleation
- secondary nucleation via the Hallett-Mossop process, in which new ice particles are generated during the riming growth of larger ice particles.
- other secondary ice nucleation mechanisms such as evaporative break-up
- the dependence of these processes on the dynamical environment within the cloud (and in particular the strength of embedded convective updraughts)

In-situ measurements from the aircraft are performed in close coordination with the Camra radar facility at Chilbolton, Hants. The radar may identify features such as embedded convective cells or layers of supercooled liquid water that can be investigated more intensively by the aircraft. Similarly, the aircraft can provide information on microphysical characteristics to aid interpretation of the radar data.

**Weather conditions:** A stratiform cloud band lying over or to the west of the Chilbolton radar facility. This may or may not be generating precipitation at the surface. It is particularly desirable if the mean wind direction lies between about 220 and 280 degrees. This allows the aircraft to fly legs along the radar beam whilst staying closely parallel to the mean wind direction, and hence to more easily penetrate identifiable cloud features on successive runs at the same altitude. Note that to avoid interference with Bournemouth airport, Chilbolton is NOT allowed to transmit in the sector 209 to 219 degrees true.

**Key instruments and their operation.**

Basic meteorology

- Rosemount temperatures, GE hygrometer
- GPS, INU, turbulence probe – When in supercooled liquid water, Flight Manager or PIs should monitor turbulence probe calibrated differential pressures for signs of icing (cessation of variability on signal).

Cloud Physics

- FFSSP, 2DC, 2DP, PCASP, SID-1 (and SID-2). Normal monitoring to ensure correct operation. Operator should note particular features of interest eg. high concentrations, appearance of pristine ice crystal habits, appearance of large drops (>100micron) in 2D imagery when above freezing level.
- ADA/CPI – as above
- CCN measurements should be made by filling the alleviator whilst in clear air either below, between or upwind of the cloud layer(s) of interest.
- If required, Ice Nucleus counter (INC) will normally be operated in clear air and under fixed conditions of temperature and supersaturation so as to maintain it in a stable condition. Allow additional time between runs for the operator to adjust it to a different set of conditions.
- J-W LWC and Nevzorov LWC/TWC. Where a run is only partially in cloud and is starting in clear air, these should be zeroed/calibrated and a note made in the Flight Manager's log.
- TWC. If possible, a profile in clear air is desirable for calibration purposes.

## SORTIE DEBRIEF

## CWVC Mixed Phase Cloud.

**Flight number B098** 26 May 2005

**Assessment of the flight**

Takeoff from Cranfield. Transit to operating area at FL050.

Profile (P1) starting above Chilbolton, from FL035 to FL270.

Run (R1) at FL220 inbound to Chilbolton. Radar reports problems, so do a stack of runs at various heights.

Run (R2) at FL210 outbound. In cloud, 4/8 Sc below.
Run (R3) at FL210 inbound.

Run (R4) at FL230 outbound, in cloud initially, but near base. Run out of clound midway through run. For future runs, decrease time and do inbound and outbound at each height.

Run (R4.1) at FL250 inbound, in cloud initially. Run (R4.2) at FL250 outbound.

Run (R5.1) at FL270 inbound, in clear air or very patchy cloud. Run (R5.2) at FL270 outbound.

Profile (P2) from FL230 to FL310. Cannot reach cloud.

Run (R6) at FL200 inbound.

Transit back to Cranfield..

# Mission Scientist's Log

M. Sci - Richard Cotton. CWVC 2.2

Flight No **B**.098..... Date 26/05/05..... Page 1 of 3

| GMT | Run / Profile | Height | Hdg | GPS Position | Remarks (clouds, weather, visibility, winds, sea state etc.) |
|---|---|---|---|---|---|
| | T to Chil | 5000' | 163 | 51.7N/1.6W | CPI / ADA not seeing anything |
| 10:07:56 | P1 st | 3500' | | | Inbnd Profile 3500 - 24000 |
| 10:18:50 | | 14200 | | | -4.79 / 10.25°C 590mb |
| 10:21:40 | | 17000 | | | -11.4 / -14.71 25m/s / 22 |
| 10:22.31 | P2 mt | FL180 | 248 | | |
| | P1 rec | FL180 | | | -13.3 / -16.29 28 m/s / 226 |
| | | | | | Radar seeing cloud 20 000 - 36 000' |
| 10:28:05 | | | | | Inbound 100km Runs |
| | | | | | CPI seeing orgs/cloud - |
| 10:33:36 | P1 [redacted] | 23 600 | 77 | 51.0/1.8W | -22.8/-24.36°C 23/235° 393 |
| 10:35:13 | P1 mt | 25 000 | | | Combinations: Plates, Bin/Hol R., poly X, SIR, Drops? |
| 10:36:00 | P1 mt. | 25 000 | 251 | 51.0/2.6W | -26.05/-27.24 375mb 26/233° |
| 10:41:07 | P1 rc. | FL250 | 251 | | → FL 250 |
| 10:41:08 | | | | | |
| 10:45:36 | P1.3 end | FL250 | | | End profile |
| 10:46:40 | | | | | Run 3 ADA (forgot to start it) - sunlight only |
| | | | | | Laser ~ 310 |
| 10:47:00 | | | | | PCASP low 30/cm³ Mean Rad 0.2 |
| 10:48:19 | | | | | AMS Wahnis - turning TOF off OPC ~ 300 |
| | | | | | ADA - No signal on Shifted - ~20 on USh |
| 10:52:56 | R1 st | FL220 | 79 | 50.9/2.6W | -19.4 -19.11°C 20m/s/231° 427mb |
| | | | | | 50 km |
| | | | | | vSIR + Fe Large Poly X tals - 2D too |
| 10.59:43 | R1 end | FL22 | | | End run |
| | | | | | Radar has Problem - can't see out for - go out to 60 |

# Mission Scientist's Log

MSci – Richard Cotton. CWVC 2.2

Flight No **B**...098..... Date ...26/05/05..... 

| | GMT | Run / Profile | Height | Hdg | GPS Position | Remarks (clouds, weather, visibility, winds, sea state etc.) |
|---|---|---|---|---|---|---|
| Out | 11:02:36 | R2 st | FL210 | 250 | 51.0N/1.6W | 24/234° -18.85/17.83°C 445mb (286kts) |
| | 11:08:52 | R2 end | FL210 | " | 50.9/2.2W | -17.58/-17.08 446mb 19mb/233° |
| | | | | | | (blocked 194 / 276 winds 230/23 sh – No Shelf) |
| in. | 11:12:58 | R2.1 s | FL210 | 80 | 51.0/2.1W | To go overhead ChB. -17.69/-17.04 21/239 445 |
| | 11:18:55 | R2.1 e | FL210 | " | 51.1/1.4W | Overhead ChB – end -18.50/-17.79 28/246 |
| | | | | | | CCN Spectrum Conducted. |
| Out | 11:26:19 | R3 | FL230 | 252 | 51.0/1.6W | -21.66/-20.5°C 23/233 405mb |
| | | | | | | CPI |
| | 11:30:38 | | | | | Cirrus out of cloud layer |
| | 11:32:58 | R3 end | FL230 | | | End of Run – do reciprocal at FL250 |
| In. | 11:36:44 | R4 st | F250 | 79 | 50.9/2.3W | -25.9/-24.98 375mb 21/244° 314kts |
| | 11:40:55 | R4 end | FL250 | | 51.0/1.6W | |
| Out | 11:45:54 | R4.2 st | FL250 | 255 | 51.0/1.6W | 375 -25.9/-24.83 25/255 |
| | 11:48:59 | R4.2 en | FL250 | | 50.9/2.2W | -27.5/-25.5°C 33/235 |
| In | 11:53:46 | R5 | FL270 | 72 | 50.9/2.2W | -30.77/-28.83 26/243 344mb (324kts) |
| | 11:57:18 | R5 en | | | 51.0/1.7W | 343mb ele |
| Out | 12:00:27 | R5.2 st | FL270 | | 51.0/1.6W | 343 28/233 -30.87/-29.55°C |
| | 12:12.08 | R5.2 end | FL270 | 269 | 50.5/2.9W | 344. -30.42/-29.03°C 24/249. |
| In. | 12:15:29 | P2 | FL270 | | 50.5/2.6W | P2. start – towards ChB – Clear Air |
| | | | | | | Cloud to South – can't go there |
| | 12:22:32 | P2.1 | FL320 | | 51.0/1.0W | end Profile – Descent |
| Out | 12:26:26 | P2.2 st | FL320 | 246 | 51.0/1.7 | -43.6/-42.55 32/241 272mb |
| Out | 12:29:08 | P.22 end | FL330 | | | end – descending to observed $C_i$ |
| | | | | | | Descend to search for CPI – Error |
| | | | | | | Will Stop / Start Probe |

# Mission Scientist's Log

MSci – Richard Cotton  CWVC

Flight No **B**...098.....  Date .....26/05/09.....  Page 3 of 3

| | GMT | Run / Profile | Height | Hdg | GPS Position | Remarks (clouds, weather, visibility, winds, sea state etc.) |
|---|---|---|---|---|---|---|
| on | 12:39:09 | R6 st | FL200 | | | Above All Cloud |
| | 12:40:00 | R6 | FL200 | 79 | 50.9/2.5W | -16.99/-16.44°C 21/245° 404mb |
| | | | | | | too low nav? – CPI rolling |
| in | 12:45:20 | R6 end | FL200 | | | |
| out | 12:50:33 | R7 | FL160 | | 2.0 | -9.21/-9.36°C 23/242 547 |
| | | | | | | CPI seeing large strong Xtals + drops? |
| out | 12:56.09 | R7 end | FL160 | | 50.9/2.4 | -9.56°C/-18.68 547mb 36/245° dim |
| in | 13:00:01 | R7.2 st | FL160 | 88 | 50.9/24 | -9.65°C/-17.9°C 547 29/243 |
| | 13:04:08 | R7.2 end | FL160 | 76 | | 552 -8.76/-9.87 |
| | | | | | | |
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| | | | | | | Cranfield 14:30 BST ETA |

# CORE CHEMISTRY PRE FLIGHT LOG

| PRE POWER UP | |
|---|---|
| All sample lines are connected to the rack | Y |
| All cylinders pressures are OK | Y |
| Ozone Span = 504, Offset = 50 | Y |

| GAS PRESSURES | $N_2$ (bar) | $CO_2$ / Argon (bar) | CO standard (bar) |
|---|---|---|---|
| PRE FLIGHT | 52 | 128 | 135 |
| POST FLIGHT | 30 | 125 | 135 |

| POST POWER UP – GROUND | | | | |
|---|---|---|---|---|
| **Ozone Sample Flow 1 (LPM)** | **Ozone Sample Flow 2 (LPM)** | **$NO_x$ Sample Flow (LPM)** | **$NO_x$ Ozonator Flow (LPM)** | **$SO_2$ Sample Flow (LPM)** |
| .4 | .4 | 1.108 | .065 | .437 |
| **CO Time check against HORACE** | **CO Lamp Flow (ml/min)** | **Pressure Monochromator (bar)** | **Pressure Cell (Torr)** | |
| Spot on! | 33.95 | 1.09 | 7.13 | |

| ZEROS | | | | | | | Average |
|---|---|---|---|---|---|---|---|
| **Ozone (ppbV)** | -1 | 1 | 0 | -2 | -2 | -1 | -0.8 |
| **NO (ppbV)** | 13.8 | 13.7 | 13.8 | 13.8 | 13.8 | 13.7 | 13.8 |
| **$NO_2$ (ppbV)** | 14.0 | 14.0 | 13.6 | 13.2 | 12.9 | 12.7 | 13.4 |
| **$NO_X$ (ppbV)** | 27.7 | 27.4 | 27.4 | 26.7 | 26.7 | 26.4 | 27.1 |
| **$SO_2$ (ppbV)** | -.71 | -.21 | -.42 | -.54 | -.09 | -.52 | -.42 |

## PRE FLIGHT COMMENTS

Apparent NOx leak. Zeros rubbish and leak test flow does not approach zero.

# CORE CHEMISTRY CALIBRATION AND FLOW LOG

| PREVIOUS CO CAL | Date and Flight Level | Sensitivity (Hz/ppbV) | Bkgrd (ppbV) | Bkgd Cnt R (Hz) |
|---|---|---|---|---|
| | | | | |

| Time | Flight Level | CO | | | | |
|---|---|---|---|---|---|---|
| | | Sensitivity (Hz/ppbV) | Bkgrd (ppbV) | Bkgd Cnt R (Hz) | Lamp Temp (°C) | Cell Press (Torr) |
| 10:00 ish Bad cal | 50 | 19.67 | 335.95 | 6608.59 | 50 | 7.13 |
| | | Flows (LPM unless stated) | | | | |
| | | CO Lamp Gas (ml/min) | Ozone Sample 1 | Ozone Sample 2 | $NO_x$ Sample | $NO_x$ Ozonator | SO2 Sample |
| | | 33.87 | .5 | .5 | 1.100 | .0063 | .4 |
| Time | Flight Level | CO | | | | |
| | | Sensitivity (Hz/ppbV) | Bkgrd (ppbV) | Bkgd Cnt R (Hz) | Lamp Temp (°C) | Cell Press (Torr) |
| 10:11:08 Bad cal | 35 | 75.05 | 85.45 | 6638.57 | 50 | 7.13 |
| | | Flows (LPM unless stated) | | | | |
| | | CO Lamp Gas (ml/min) | Ozone Sample 1 | Ozone Sample 2 | $NO_x$ Sample | $NO_x$ Ozonator | SO2 Sample |
| | | 33.88 | 0.6 | 0.7 | 1.101 | 0.067 | .366 |
| Time | Flight Level | CO | | | | |
| | | Sensitivity (Hz/ppbV) | Bkgrd (ppbV) | Bkgd Cnt R (Hz) | Lamp Temp (°C) | Cell Press (Torr) |
| 11:03:48 | 220 | 80.43 | 81.27 | 6536.16 | 50 | 7.14 |
| | | Flows (LPM unless stated) | | | | |
| | | CO Lamp Gas (ml/min) | Ozone Sample 1 | Ozone Sample 2 | $NO_x$ Sample | $NO_x$ Ozonator | SO2 Sample |
| | | 33.48 | .8 | .8 | 1.023 | .066 | .220 |
| Time | Flight Level | CO | | | | |
| | | Sensitivity (Hz/ppbV) | Bkgrd (ppbV) | Bkgd Cnt R (Hz) | Lamp Temp (°C) | Cell Press (Torr) |
| 11:17:24 | 210 | 81.81 | 80.26 | 6565.67 | 50 | 7.13 |
| | | Flows (LPM unless stated) | | | | |
| | | CO Lamp Gas (ml/min) | Ozone Sample 1 | Ozone Sample 2 | $NO_x$ Sample | $NO_x$ Ozonator | SO2 Sample |
| | | 33.93 | .8 | .8 | 1.022 | 0.066 | 0.216 |
| Time | Flight Level | CO | | | | |
| | | Sensitivity (Hz/ppbV) | Bkgrd (ppbV) | Bkgd Cnt R (Hz) | Lamp Temp (°C) | Cell Press (Torr) |
| 11:29:43 | 230 | 82.16 | 80.15 | 6584.82 | 50 | 7.14 |
| | | Flows (LPM unless stated) | | | | |
| | | CO Lamp Gas (ml/min) | Ozone Sample 1 | Ozone Sample 2 | $NO_x$ Sample | $NO_x$ Ozonator | SO2 Sample |
| | | 33.89 | 0.8 | 0.8 | 0.067 | 1.017 | 0.198 |
| Time | Flight Level | CO | | | | |
| | | Sensitivity (Hz/ppbV) | Bkgrd (ppbV) | Bkgd Cnt R (Hz) | Lamp Temp (°C) | Cell Press (Torr) |
| 11:40:02 | 250 | 82.09 | 79.50 | 6526.3 | 50 | 7.14 |
| | | Flows (LPM unless stated) | | | | |
| | | CO Lamp Gas (ml/min) | Ozone Sample 1 | Ozone Sample 2 | $NO_x$ Sample | $NO_x$ Ozonator | SO2 Sample |
| | | 33.93 | .8 | .8 | 1.002 | .068 | .170 |
| Time | Flight Level | CO | | | | |
| | | Sensitivity (Hz/ppbV) | Bkgrd (ppbV) | Bkgd Cnt R (Hz) | Lamp Temp (°C) | Cell Press (Torr) |
| 11:55:46 | 270 | 81.46 | 80.01 | 6517.8 | 50 | 7 |
| | | Flows (LPM unless stated) | | | | |
| | | CO Lamp Gas (ml/min) | Ozone Sample 1 | Ozone Sample 2 | $NO_x$ Sample | $NO_x$ Ozonator | SO2 Sample |
| | | 33.94 | .8 | .8 | 1.012 | .066 | .151 |

| Time | Flight Level | CO | | | | |
|---|---|---|---|---|---|---|
| | | Sensitivity (Hz/ppbV) | Bkgrd (ppbV) | Bkgd Cnt R (Hz) | Lamp Temp (°C) | Cell Press (Torr) |
| 12:25:48 | 320 | 78.61 | 82.11 | 6454.25 | 50 | 6.27 |
| | | Flows (LPM unless stated) | | | | |
| | | CO Lamp Gas (ml/min) | Ozone Sample 1 | Ozone Sample 2 | $NO_x$ Sample | $NO_x$ Ozonator | SO2 Sample |
| | | 33.82 | .8 | .8 | .947 | .062 | 0 |
| **Time** | **Flight Level** | **CO** | | | | |
| | | **Sensitivity (Hz/ppbV)** | **Bkgrd (ppbV)** | **Bkgd Cnt R (Hz)** | **Lamp Temp (°C)** | **Cell Press (Torr)** |
| 12:37:40 | 200 | 79.87 | 80.67 | 6443.63 | 50 | 7.13 |
| | | **Flows (LPM unless stated)** | | | | |
| | | **CO Lamp Gas (ml/min)** | **Ozone Sample 1** | **Ozone Sample 2** | **$NO_x$ Sample** | **$NO_x$ Ozonator** | **SO2 Sample** |
| | | 33.82 | 0.8 | .8 | 1.019 | 0.066 | .231 |
| **Time** | **Flight Level** | **CO** | | | | |
| | | **Sensitivity (Hz/ppbV)** | **Bkgrd (ppbV)** | **Bkgd Cnt R (Hz)** | **Lamp Temp (°C)** | **Cell Press (Torr)** |
| 12:53:36 | 160 | 80.55 | 81.02 | 6526.37 | 50 | 7.13 |
| | | **Flows (LPM unless stated)** | | | | |
| | | **CO Lamp Gas (ml/min)** | **Ozone Sample 1** | **Ozone Sample 2** | **$NO_x$ Sample** | **$NO_x$ Ozonator** | **SO2 Sample** |
| | | 33.88 | .8 | .8 | 1.051 | .066 | .278 |
| **Time** | **Flight Level** | **CO** | | | | |
| | | **Sensitivity (Hz/ppbV)** | **Bkgrd (ppbV)** | **Bkgd Cnt R (Hz)** | **Lamp Temp (°C)** | **Cell Press (Torr)** |
| | | | | | | |
| | | **Flows (LPM unless stated)** | | | | |
| | | **CO Lamp Gas (ml/min)** | **Ozone Sample 1** | **Ozone Sample 2** | **$NO_x$ Sample** | **$NO_x$ Ozonator** | **SO2 Sample** |
| | | | | | | | |
| **Time** | **Flight Level** | **CO** | | | | |
| | | **Sensitivity (Hz/ppbV)** | **Bkgrd (ppbV)** | **Bkgd Cnt R (Hz)** | **Lamp Temp (°C)** | **Cell Press (Torr)** |
| | | | | | | |
| | | **Flows (LPM unless stated)** | | | | |
| | | **CO Lamp Gas (ml/min)** | **Ozone Sample 1** | **Ozone Sample 2** | **$NO_x$ Sample** | **$NO_x$ Ozonator** | **SO2 Sample** |
| | | | | | | | |
| **Time** | **Flight Level** | **CO** | | | | |
| | | **Sensitivity (Hz/ppbV)** | **Bkgrd (ppbV)** | **Bkgd Cnt R (Hz)** | **Lamp Temp (°C)** | **Cell Press (Torr)** |
| | | | | | | |
| | | **Flows (LPM unless stated)** | | | | |
| | | **CO Lamp Gas (ml/min)** | **Ozone Sample 1** | **Ozone Sample 2** | **$NO_x$ Sample** | **$NO_x$ Ozonator** | **SO2 Sample** |
| | | | | | | | |
| **Time** | **Flight Level** | **CO** | | | | |
| | | **Sensitivity (Hz/ppbV)** | **Bkgrd (ppbV)** | **Bkgd Cnt R (Hz)** | **Lamp Temp (°C)** | **Cell Press (Torr)** |
| | | | | | | |
| | | **Flows (LPM unless stated)** | | | | |
| | | **CO Lamp Gas (ml/min)** | **Ozone Sample 1** | **Ozone Sample 2** | **$NO_x$ Sample** | **$NO_x$ Ozonator** | **SO2 Sample** |
| | | | | | | | |

## CORE CHEMISTRY FLIGHT LOG

### GENERAL COMMENTS

# CLOUD PHYSICS LOG

**Flight No. B098** **Date: 26/05/05** **Operator: JT** **Page 1 of**

| G.M.T. | PCASP | | FSSP | SID1 | 2D2-C | | | 2D2-P | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS Time | Conc/cc | Mean R | Block Transfer | Particle Count | Conc/L | Max Size | Habit | Conc/m3 | Max Size | Habit | |
| 10:07:58 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Profile 1 @ 3500ft |
| 10:08:37 | 0 | 0 | 10 | 1000 | 0 | 0 | 0 | 0 | 0 | 0 | 4000ft |
| 10:09:33 | 14 | 0.07 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5000ft |
| 10:10:34 | 12 | 0.07 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 10:11:31 | 2 | 0.07 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 10:12:24 | 32 | 0.08 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 10:13:27 | 27 | 0.08 | 11 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 10:14:29 | 28 | 0.08 | 11 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 10:15:27 | 37 | 0.08 | 11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 10:16:29 | 20 | 0.08 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 10:17:24 | 15 | 0.08 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 10:18:30 | 13 | 0.09 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 10:19:27 | 28 | 0.09 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 10:20:27 | 17 | 0.09 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 10:21:27 | 21 | 0.09 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| 10:22:30 | 16 | 0.09 | 11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 18 profile interputed |
| 10:27:21 | 30 | 0.09 | 12 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 18 profile restarted |
| 10:28:33 | 13 | 0.08 | 12 | 70 | 1 | 400 | 10 | 83 | 400 | 10 | 19 |
| 10:29:30 | 8 | 0.19 | 12 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 10:30:42 | 3 | 0.1 | 12 | 0 | 14 | 625 | 10 | 700 | 200 | 10 | 21 |
| 10:31:49 | 0 | 0.05 | 12 | 10 | 0.5 | 100 | 10 | 100 | 200 | 10 | 22 |
| 10:32:56 | 0 | 0.08 | 12 | 5 | 4.5 | 100 | 8 | 2800 | 200 | 8 | 23 |
| 10:34:08 | 0 | 0 | 12 | 0 | 3.5 | 200 | 8 | 33 | 200 | 8 | 24 |
| 10:35:13 | 2 | 0.1 | 13 | 100 | 15 | 450 | 8 | 3733 | 200 | 8 | 25 profile interupted temp –26 dp |
| 10:41:27 | 11 | 0.18 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 profile restarted |
| 10:42:33 | 7 | 0.15 | 21 | 10 | 6 | 475 | 8 | Noise | | | 26 |
| 10:44:18 | 7 | 0.7 | 22 | 2 | 0 | 0 | 0 | Noise | 0 | 0 | 27 |
| 10:45:35 | 2 | 1.1 ?? | 23 | 100 | 11 | 250 | 10 | Noise | | | 28 profile stop |
| 10:52:56 | 2 | 0.5 | 27 | 75 | 15 | 400 | 8 | 1725 | 400 | 8 | Run 1 @ FL220 |
| 10:54:00 | 1 | 0.06 | 27 | 0 | 0.5 | 200 | 10 | 83 | 200 | 10 | |
| 10:56:00 | 6 | 0.1 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 10:58:10 | 7 | 0.7 | 27 | 80 | 25 | 525 | 8 | 2700 | 200 | 8 | |

# CLOUD PHYSICS LOG

**Flight No. B098** **Date: 26/05/05** **Operator: JT** **Page 2 of**

| G.M.T. | PCASP | | FSSP | SID1 | 2D2-C | | | 2D2-P | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS Time | Conc/cc | Mean R | Block Transfer | Particle Count | Conc/L | Max Size | Habit | Conc/m3 | Max Size | Habit | |
| 10:59:45 | 8 | 0.06 | 28 | 10 | 17 | 500 | 9 | 1000 | 500 | 9 | End or run 1 |
| 11:02:36 | 15 | 0.07 | 29 | 2 | 0 | 0 | 0 | 2000 | 200 | 8 | Start run 2 @ FL210 |
| 11:04:00 | 21 | 0.15 | 29 | 10 | 6 | 650 | 8 | 975 | 800 | 8 | |
| 11:06:00 | 13 | 0.1 | 30 | 2 | 2 | 800 | 8 | 333 | 800 | 8 | |
| 11:08:30 | 7 | 0.14 | 30 | 70 | 4 | 500 | 8 | 1933 | 100 | 8 | End of run 2 |
| 11:12:58 | 11 | 0.45 | 35 | 100 | 30 | 700 | 8 | 2983 | 100 | 8 | Start run 2.1 |
| 11:14:00 | 20 | 0.15 | 35 | 10 | 3 | 600 | 8 | 283 | 1000 | 8 | |
| 11:16:00 | 19 | 0.07 | 36 | 10 | 7 | 600 | 8 | 3250 | 1500 | 8 | |
| 11:18:53 | 36 | 0.6 | 38 | 100 | 53 | 525 | 8 | 2883 | 800 | 8 | End of run 2.1 |
| 11:26:20 | 1 | 0.1 | 42 | 100 | 44 | 375 | 8 | 4458 | 100 | 8 | Start run 3 FL230 |
| 11:28:00 | 16 | 0.7 | 44 | 200 | 50 | 700 | 8 | 10650 | 800 | 8 | |
| 11:30:00 | 205 | 1.1 | 47 | 60 | 0.5 | 200 | 8 | 2750 | 500 | 8 | |
| 11:32:32 | 12 | 0.06 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | End of run 3 |
| 11:36:50 | 9 | 0.31 | 47 | 10 | 0.5 | 375 | 8 | 150 | 400 | 8 | Start run 4 @ FL250 |
| 11:38:00 | 4 | 0.07 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 11:40:55 | 82 | 1.06 | 48 | 100 | 36 | 625 | 8 | 10983 | 800 | 8 | End of Run 4 |
| 11:43:55 | 24 | 0.8 | 55 | 100 | 46 | 800 | 8 | 12691 | 800 | 8 | Start of run 4.1 |
| 11:45:00 | 37 | 0.85 | 58 | 150 | 22 | 600 | 9 | 1150 | 600 | 9 | |
| 11:47:00 | 250 | 0.93 | 59 | 100 | 150 | 425 | 8 | 900 | 400 | 8 | |
| 11:49:46 | 7 | 0.29 | 60 | 100 | 18 | 200 | 10 | 700 | 400 | 10 | End of run 4.1 |
| 11:53:45 | 2 | 0.05 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Start Run 5 @ FL270 |
| 11:55:00 | 1 | 0.05 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 11:57:16 | 4 | 0.05 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | End of Run 5 |
| 12:00:27 | 1 | 0 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Start of Run 5.1 |
| 12:02:00 | 1 | 0.05 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 12:04:00 | 1 | 0.06 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 12:06:00 | 12 | 0.16 | 61 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 12:08:00 | 16 | 0.07 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 12:10:00 | 4 | 0.08 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 12:12:07 | 11 | 0.1 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | End Run 5.1 |
| 12:15:29 | 10 | 0.07 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Start Profile @ FL270 |
| 12:16:42 | 3 | 0.07 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | FL280 |

# CLOUD PHYSICS LOG

**Flight No. B** **Date:** **Operator:** **Page of**

| G.M.T. | PCASP | | FSSP | SID1 | 2D2-C | | | 2D2-P | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS Time | Conc/cc | Mean R | Block Transfer | Particle Count | Conc/L | Max Size | Habit | Conc/m3 | Max Size | Habit | |
| 12:17:51 | 4 | 0.08 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | FL290 |
| 12:19:00 | 2 | 0.08 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | FL300 |
| 12:20:29 | 2 | 0.08 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | FL310 |
| 12:22:32 | 5 | 0.06 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | FL320 End of Profile 2.1 |
| 12:26:26 | 1 | 0.11 | 61 | 0 | 0 | 0 | 0 | 37345 NOISE | | | FL320 recommence profile |
| 12:29:08 | 4 | 0.09 | 61 | 2 | 0 | 0 | 0 | NOISE | | | FL330 end of profile |
| 12:39:09 | 7 | 0.08 | 61 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | Start run 6 @ FL200 |
| 12:41:00 | 7 | 0.07 | 61 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 12:43:00 | 14 | 0.07 | 61 | 0 | 0.5 | 100 | 1? sph | 0 | 0 | 0 | (spherical but –17C) |
| 12:45:20 | 14 | 0.08 | 62 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | N.B. FFSSP 20 sec late |
| | | | | | | | | | | | End of run |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | N.B. FFSSP 20 sec late |
| | | | | | | | | | | | |
| 12:50:34 | 19 | 0.1 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Start run 7 @ FL160 |
| 12:52:00 | 4 | 0.09 | 62 | 10 | 2.5 | 800 | 9 | 108 | 1000 | 9 | |
| 12:54:00 | 45 | 0.1 | 62 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 12:56:00 | 26 | 0.09 | 62 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | End of run 7 |
| 13:00:01 | 41 | 0.09 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Start of run 7.1 |
| 13:02:00 | 42 | 0.08 | 62 | 7 | 1.5 | 800 | 8 | 280 | 800 | 8 | |
| 13:04:00 | 98 | 0.14 | 62 | 0 | 5 | 800 | 8 | 183 | 1000 | 8 | End run 7 |
| | | | | | | | | | | | |
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Flight No B098

# CCNC LOG

PAPS.

Exp. Chilbotha.

Date 26/5/05

Page 1 of

| ALLEVIATOR GMT ON | ALLEVIATOR GMT OFF | Height | TEMP INLET | STATIC 1 | 2 | 3 | 4 | 5 | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1.75 | 2.5 | 3.5 | 4.25 | 5.5 | | |
| 111320 | 111400 | 210 | 25 | 0:49 | 0.72 | 1.08 | 1041 | 2.05 | S | |
| | | | 24.49 | 486 | 651 | 875 | 642 | 754 | D | |
| | | | 24.49 | 389 | 388 | 385 | 386 | 393 | B | |
| | | | 24.01 | 2278 | 2287 | 2295 | 2300 | 2307 | R | |
| | | | | 896.4 | 896.1 | 895.7 | 896.1 | 896.1 | P | |
| Run | | | | | | | | | | |
| 4 | 113733 | 250 | 23.05 | 0.5 | 0.74 | 1.1 | 1041 | 2.07 | S | |
| | 113815 | | 24.14 | 477 | 463 | 603 | 1227 | 1400 | D | |
| | | | 22.7 | 417 | 412 | 410 | 424 | 463 | B | |
| | | | 22.64 | 2311 | 2324 | 2328 | 2327 | 2329 | R | |
| | | | 23.09 | 856 | 857 | 857 | 856 | 856.3 | P | |
| | | | | | | | | | | |
| | | | | 1.75 | 2.5 | 3.5 | 4.25 | 5.5 | | |
| | | 270 | 23 | 0.50 | 0.72 | 1.1 | | | S | |
| 1153 | 115345 | | 23 | 349 | 409 | | | | D | |
| | | | | 409 | 410 | 40 | | | B | Failed |
| | | | | 2304 | 2305 | 2300 | | | R | |
| | | | | 836.8 | 836 | 837.7 | | | P | |
| | | | | | | | | | | |
| | | | 22.65 | 0.5 | 0.73 | 1.09 | 1.42 | 2.07 | S | |
| 12.0/10 | 1202 | 270 | 23.06 | 431 | 443 | 440 | 425 | 450 | D | |
| | | | | 393 | 406 | 412 | 413 | 413 | B | |
| | | | | 2286 | 2286 | 2285 | 2279 | 2279 | R | |
| | | | | 836.4 | 836.8 | 836 | 837 | 837 | P | |
| | | | | | | | | | | |
| | | | | 1.75 | 2.5 | 3.5 | 4.25 | 5.5 | | |
| 123930 | 124016 | 160 | 24 | 0451 | 0.71 | 1.08 | 1.04 | 2.02 | S | |
| | | | 23.71 | 431 | 444 | 589 | 820 | 623 | D | |
| | | | 22.5 | 399 | 416 | 426 | 430 | 438 | B | |
| | | | 24.5 | 2241 | 2279 | 2294 | 2296 | 2288 | R | |
| | | | 24.5 | 904 | 922 | 937 | 937.6 | 937 | P | |
| | | | | | | | | | | |
| 125515 | 1256 | 160 | 24.75 | 0.5 | 0.72 | 1.1 | | | S | |
| | | | 24 | 484 | 497 | 648 | | | D | |
| | | | 24 | 412 | 454 | 468 | | | B | |
| | | | | | 2349 | 2356 | | | R | |
| | | | | 2278 | 937.4 | 937.6 | | | P | |
| | | | | 937.3 | | | | | | |

Flight Manager's Instrument Status Log

Flight No. **B**098 Date: 25/05/05

| Instrument | Fitted | Operated | Instrument | Fitted | Operated |
|---|---|---|---|---|---|
| **Navigation** | | | **Cloud Physics** | | |
| INU | | **Y** | **Probes** | | |
| GPS | | **Y** | FFSSP | **Y** | **Y** |
| Satcom C | | **Y** | PCASP | **Y** | **Y** |
| Satcom H | | **Y** | 2D-P | **Y** | **Y** |
| **Thermometers** | | | 2D-C | **Y** | Y |
| De-Iced Temp | | **Y** | Cloudscope | **N** | **N** |
| Non De-Iced | | **Y** | SID 1 | **Y** | **Y** |
| Heimann | **N** | | SID 2 | **Y** | **N** |
| **Hygrometers** | | | | | |
| G. Eastern | | **Y** | HVPS | **N** | |
| J. Williams | | **Y** | CIP25 | **Y** | **N** |
| Nevzorov | | **Y** | CIP100 | **Y** | **N** |
| TWC | | **Y** | | | |
| FWVS | **Y** | **N** | **Racks:** | | |
| **Radiometers** | | | INC | **Y** | **N** |
| Upper Clear | **Y** | **Y** | CCN / CNC | **Y** | **Y** |
| " Red | **Y** | **Y** | CVI | **Y** | **Y** |
| " Silicon | **Y** | **Y** | | | |
| " JO1D | **N** | | **Aerosol** | | |
| Lower Clear | **Y** | **Y** | PSAP | **Y** | **N** |
| " Red | **Y** | **Y** | Nephelometer | **N** | |
| " Silicon | **Y** | **Y** | Filters | **Y** | **n** |
| " JO1D | **N** | | AMS | **Y** | **y** |
| **Large Radiometers** | | | | | |
| TAFTS | **N** | | | | |
| MARSS | **N** | | | | |
| DEIMOS | **N** | | **Others:** | | |
| ARIES | **N** | | NIR TDLAS | **Y** | **N** |
| SWS | **N** | | 2BT O3 | **Y** | **N** |
| **Chemistry** | | | VACC | **Y** | **N** |
| Ozone | **Y** | **Y** | PEROXIDE | **Y** | **N** |
| ECGC | **N** | | Formaldehyde | **Y** | **N** |
| NOX | **Y** | **Y** | ADA | **Y** | **n** |
| CO | **Y** | **Y** | CPI | **Y** | **Y** |
| ORAC | **Y** | **N** | NOxy | **Y** | **n** |
| PAN | **Y** | **N** | PTRMS | | **n** |
| PERCA | **Y** | **N** | Bag Sampling | | **n** |
| WAS | **Y** | **n** | | | |

# Faults / Incidents Log

**Flight No. B098**
**Date: 26/05/05**

## Instruments

1. Video – RFC display out of focus. Inboard display switches off .
2. otherwise ops normal:
    3. Cloud Physics
    4. core chem
    5. CCN

## Aircraft

Nil

**MISSING LOG SHEETS:**

The following logs are not available for flight B098:

| Log | Reason |
|---|---|
| CVI | No log is ever taken for CVI |
| CPI | Log only of interest to instrument operator so no copy left with FAAM |
| AMS | Log only of interest to instrument operator so no copy left with FAAM |
| | |
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**VIDEO RECORDINGS:**

Video recordings from this flight reside with FAAM (at 31 Oct 2005) :

2 x Forward Facing Cameras
2 x Downward Facing Cameras